COMPARING GLASS FIBER POSTS TO CAST METAL POSTS: A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background: Repairing teeth without coronal walls after endodontic therapy is challenging, requiring intra-radicular supports. Different post types with varying elastic moduli exist, but there is a lack of trials comparing their effectiveness. Tooth placement is not a significant factor in failure rates.
Aim: To compare the performance of glass fiber posts to cast metal posts in teeth without ferrules.
Methods: A retrospective study in a dental clinic in North Riyadh examined 280 medical histories of patients needing intra-radicular posts. Criteria included good oral health, limited coronal support, and absence of caries and periodontal disease. Criteria assessed included secondary caries, apical periodontitis, crown fractures, and post debonding. Success was defined as avoiding absolute and relative failures.
Results: Demographics showed no significant differences between the two groups. Cast metal posts were significantly more prevalent in the maxillary incisor area, while glass fiber posts were more prevalent in the maxillary premolar area. The glass fiber group had a longer average time until failure compared to the cast metal group. Failure causes did not significantly differ between the groups.
Conclusion: Both glass fiber and cast metal posts demonstrated comparable clinical performance. However, glass fiber posts had a longer average time until failure compared to cast metal posts. The choice of post material may impact the timing of failure but not specific failure causes.

Key words: Glass fiber, Cast Metal, posts, Restorative dentistry.

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INTRODUCTION

The absence of surviving coronal walls presents a significant challenge when it comes to the procedure of repairing teeth that have previously undergone endodontic therapy (also known as ETT). As a consequence of this, intraradicular supports are necessary in order to maintain the position of the coronal restorative material (Ranjan & Hemmanur, 2021).

According to their elastic modulus, these posts may be categorized as metallic posts (posts made of prefabricated or cast metal), ceramic posts, posts made of carbon fiber with a high elastic modulus, and posts made of glass fiber with a low elastic modulus. It is hypothesized by Sarkis-Onofre et al., (2020) that ETT that has been mended with different types of posts would exhibit mechanical behaviors that are notably unique from one another. However, there are not a lot of well-designed randomised controlled

trials that assess the use of different post types based on elastic modulus for the restoration of teeth without coronal walls, which may be a contributing factor in failures (Sterzenbach et al., 2012; Zicari et al., 2011). These papers examine the use of various post types for the restoration of teeth without coronal walls.

Because of this, it might be challenging to establish which kind of post is most suitable for the restoration of teeth that do not have coronal walls. (Sarkis-Onofre et al., 2017) When comparing cast metal and glass fibre posts, a recent systematic review highlighted the lack of trials that had longer follow-ups. However, the research also demonstrated that metal posts may work better in teeth that did not have a ferrule. Nevertheless, the existing corpus of research does not provide any evidence that can be viewed as conclusive about the probable differences that may be made between the various kinds of postings. In addition to this, it is quite important to take into consideration the success rates of the anterior as well as the posterior ETT. (Garcia et al., 2019) Although the authors of a recent systematic review acknowledged the need for studies with longer follow-up periods to validate these findings, the study revealed that tooth placement did not have a significant influence on the failure rate.

The purpose of this research is to determine whether or whether glass fiber posts exhibit a clinical performance that is comparable to that of cast metal posts in teeth that do not have a ferrule.

MATERIAL AND METHODS

This was a retrospective research with the goal of comparing the clinical performance of cast metal and glass fiber posts that were done at a dental facility in North Riyadh during the months of January and March of 2023. The investigation was carried out on the medical histories of 280 participants.

Within the context of this investigation into the past, the preliminary evaluation consisted of data assessing the oral health of the patients based on their medical histories. Participants in the study were required to fulfill certain requirements, including having good oral health, being free of caries lesions and periodontal disease, and having a need for intraradicular posts for anterior or posterior endodontically treated teeth with limited coronal support (ferrule height of 0 to 0.5 mm) and a single crown. These requirements were met by individuals who took part in the study. In addition to it, it was essential to have bilateral occlusal posterior connections. The exclusion criteria included teeth that had been endodontically treated but still had periodontal or occlusal problems, as well as massive prostheses (Kennedy Class I or II) that were opposed to the tooth that was going to be repaired. Even though all of the potential causes for failure were taken into account in the studies (success), the key outcome of interest was post loss.

The research by Sarkis-Onofre et al. (2014) served as the basis for providing specific information on the materials and processes that were used throughout the root canal treatment as well as the restorative treatments. In a nutshell, endodontic treatment using the crown-down approach was performed on each and every tooth that was part of the research study. The procedure that was followed at the hospital was for them to be irrigated with a solution containing 2.5% sodium hypochlorite (NaOCl) and filled with Grossman Cement and gutta-percha cones using the lateral condensation method. Both normal and self-adhesive resin cement were used in the process of bonding glass fiber posts.

A Centrix syringe was used to inject the resin cement into the root canal, and composite resin was used to shape the center of the restoration. Only one glass fiber post was inserted into the root canal of the biggest size in the instances of molars and premolars that had numerous root canals. The self-adhesive resin cement was used in the gluing of the cast metal posts.

After the post-cementation radiographs and records were analyzed to determine whether or not the surgery was successful. All of the teeth were crowned with a single piece of metal-ceramic material, and the crowns were set in place using self-adhesive cement.

EVALUATION PARAMETERS

In this particular research, the time period following the cementation of the crown served as the comparative baseline. The FDI criteria were used in order to perform the evaluation of the crown (Hickel et al., 2010; Sarkis-Onofre et al., 2017). Before moving on to the radiographic inspection, the first assessment concentrated on the crown by itself. This was done in accordance with a certain sequence of examination that had been decided beforehand. During the course of the assessment, a number of factors were taken into consideration. These factors included the patient's periodontal health (including probing depth and clinical attachment level), the existence of pain, the antagonist status, and the occlusion pattern. The research took notes on a number of different events and actions for further examination.

The term "secondary caries," which describes to cavities that form near restorations, was the first category of reported occurrences. The presence of apical periodontitis, clinical signs and symptoms of discomfort to percussion, or the formation of a periapical abscess draining via a fistula suggested the possibility of the endodontic treatment not being

successful. Crown fractures were also observed. These fractures included material chip fractures that compromised the marginal quality or proximal connections, as well as bulk fractures that resulted in the partial loss of the restoration (less than half).

The occurrences that were associated to post fractures were assessed, and this was done regardless of their placement on the arch or the degree to which the bone was involved. The term "crown dislodgement" referred to the loss of either the whole crown or a portion of it that made it possible to remove the crown with the use of a manual device. Post debonding refers to the entire loss of either the post alone or both the post and crown, or the partial loss that enabled the post to be manually dislodged. Post debonding may also refer to the loss of only the post. Root fractures were classified as either full fractures, which required the extraction of the tooth, or partial fractures, which may possibly be healed with surgical crown lengthening treatments. full root fractures required the evacuation of the tooth.

On the basis of their level of seriousness, failures were categorized as either absolute or relative. Absolute failures were defined as those that resulted in the removal of a tooth, while relative failures included post-debonding and the risk of recementation. When the patient returned to the examination with the post still connected, the time of failure was established by the patient's self-report of when the post became unbonded. If the patient did not return to the examination with the post still attached, the time of failure was not determined. In this particular research, the only thing that differentiated a survivor from a non-survivor was whether or not they had experienced any absolute failures. In order to be labeled a success, one must have avoided both absolute and relative failures.

ETHICAL APPROVAL:

The university's Ethics Board approved the trial, and participants signed a declaration acknowledging the risks. Participants also signed a declaration confirming they were told of the study's risks. The Declaration of Helsinki, commonly known as the World Medical Association Code of Ethics, ensures ethical medical research on humans.

STATISTICAL ANALYSIS:

IBM SPSS 24 (May 2016) assessed the data. Kristall-Wallis, Wilcoxon, Spearman, and logistic regression tests assessed statistical significance. All variables were evaluated for parametric or nonparametric data. The statistical significance threshold was 0.05, or five percent.

RESULTS

Table (1): Demographic data of included subjects

	Cast metal posts (N = 124)		**Glass fiber posts (N = 156)**		**P. Value**
Age (Mean SD)	44.63 ± 12.65		43.81 ± 11.51		0.5714
Sex	**Number**	**Percentage**	**Number**	**Percentage**	
• **Male**	28	22.58	42	26.92	0.4045
• **Female**	96	77.42	114	73.08	
Residence	**Number**	**Percentage**	**Number**	**Percentage**	
• **Urban**	51	41.13	63	40.38	0.8998
• **Rural**	73	58.87	93	59.62	

In terms of the demographic data of the people who participated in both studies, there was no discernible difference between the two groups.

Table (2): Dental Group in both study groups

	Cast metal posts (N = 124)		**Glass fiber posts (N = 156)**		**P. Value**
Dental Group	**Number**	**Percentage**	**Number**	**Percentage**	
Maxillary Incisor	62	50	55	35.26	0.01297*
Maxillary Canine	7	5.65	3	1.92	0.0955
Maxillary Premolar	17	13.71	45	28.85	0.00244*
Maxillary Molar	10	8.06	14	8.97	0.78705

Mandibular Incisor	7	5.65	3	1.92	0.0955
Mandibular Canine	3	2.42	1	0.64	0.21291
Mandibular Premolar	9	7.26	22	14.1	0.06982
Mandibular Molar	9	7.26	13	8.33	0.73977

In the maxillary incisor area, the cast metal post group had 62 cases (50% of the total), whereas the glass fiber post group had 55 instances (35% of the total). A statistical analysis found a statistically significant increase in cast metal posts group (p = 0.01297). However, no statistically significant changes in post distribution were identified in the maxillary canine and mandibular incisor locations.
In the maxillary premolar area, the dental group that used cast metal posts had fewer cases, 17 cases (13.71%), than the group that used glass fiber posts, which had 45 cases (28.85%). The statistical analysis revealed a significant difference (p = 0.00244) between the two groups. The distribution of cast metal posts vs glass fiber posts in the maxillary molar area, mandibular canine region, mandibular premolar region, and mandibular molar region, on the other hand, showed no statistically significant differences.

Table (3): Failure data and cause in both study groups

	Cast metal post (N = 10)	**Glass fiber post (N = 11)**	**P. Value**
Time of Failure (in months)	35.1 ± 25.39	48.14 ± 30.9	0.0002*
Failure Reason			
• **Crown and post debonding**	1 (10%)	1 (9.09%)	0.8703
• **Crown debonding**	2 (20%)	6 (54.55%)	0.2652
• **Endodontic failure**	0 (0%)	1 (9.09%)	0.37178
• **Post debonding**	2 (20%)	2 (18.18%)	0.81674
• **Root fracture**	5 (50%)	10 (90.91%)	0.38005
• **Secondary caries**	0 (0%)	1 (9.09%)	0.37178

The collected data revealed that the group using glass fiber posts exhibited a significantly longer average duration until failure, with an average of 48.14 months, compared to the group using cast metal posts, which had an average of 35.1 months until failure. The analysis of failure causes, including crown and post debonding, crown debonding, endodontic failure, post debonding, root fracture, and secondary caries, did not show any statistically significant differences between the two groups. Although there were variations in the frequencies of different failure causes, the p-values indicated that these differences did not reach statistical significance. These findings suggest that while the choice of post material in dental procedures may impact the timing of failure, it may not have a substantial influence on specific failure causes.

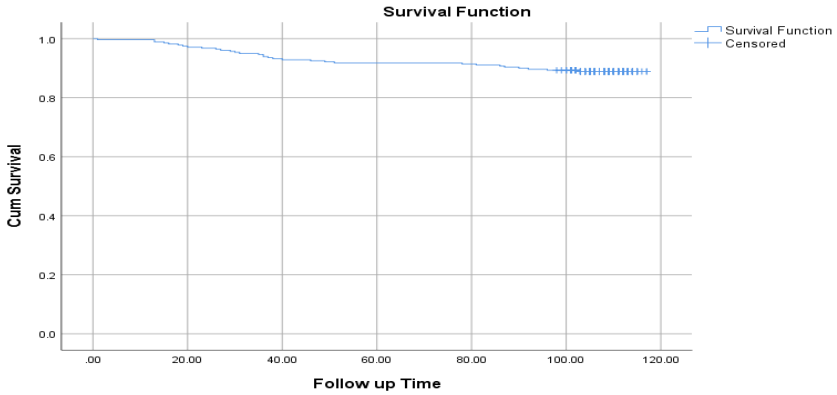

Figure (1): The Kaplan-Meier curve illustrates the survival function over all people included..

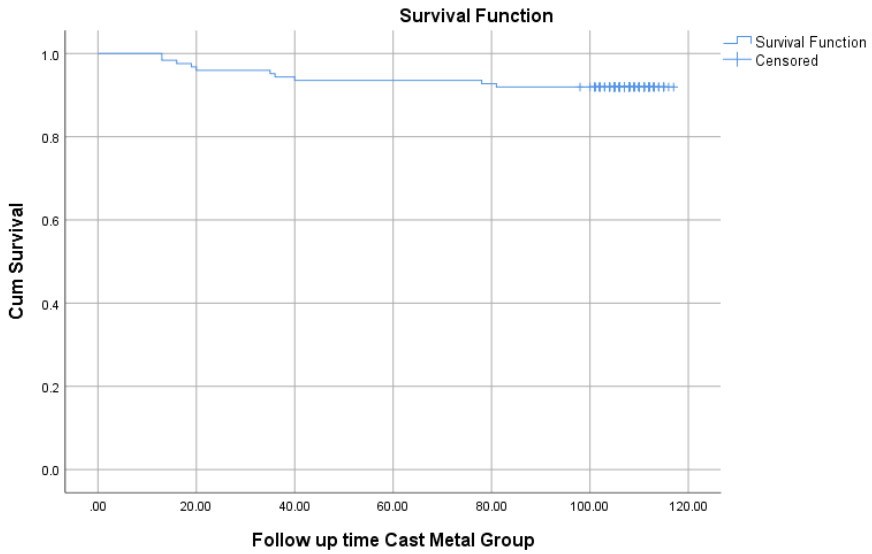

Figure (2): Cast Metal group's Kaplan Meier curve, which depicts the function of survival over time.

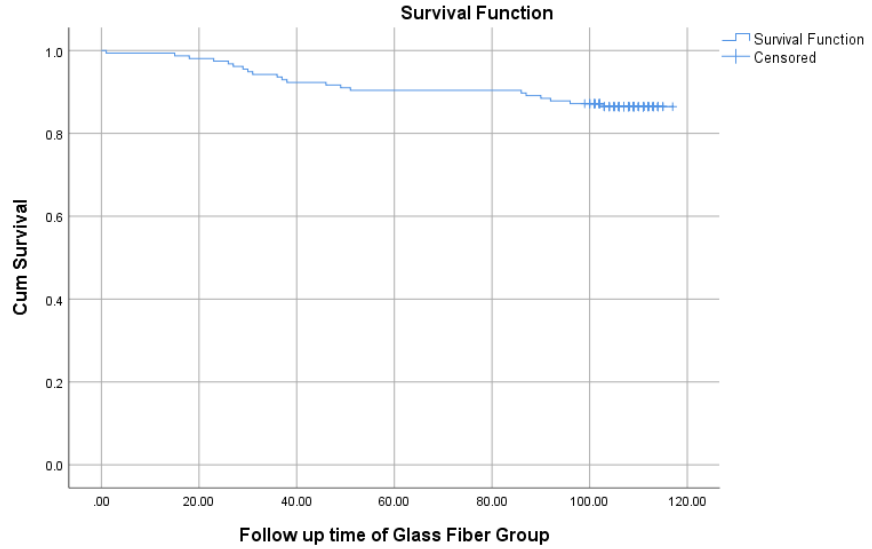

Figure (3): Survival function according to Kaplan and Meier for the Glass Fiber group

DISCUSSION

According to Sarkis-Onofre et al. (2017), studies that looked at posts with a high elastic modulus had longer follow-up periods than those that looked at glass fiber posts. The study emphasized that studies focusing on glass fiber posts had shorter follow-up periods than studies focusing on other kinds of posts. This discovery helped the scientific community get a better knowledge of the subject.

Skupien et al. (2016) revealed in a recent meta-analysis that the presence of a ferrule had a good influence on the survival of endodontically treated teeth (ETT), especially premolars. The researchers determined that the presence of a ferrule had a major impact on the long-term performance of ETT. This data supports the usefulness of a ferrule in improving ETT prognosis. It is a prominent illustration of the difficult conditions encountered during ETT repairs when there is no ferrule and no residual coronal walls. This is a scenario in which there is neither a ferrule nor any remaining coronal walls. Glass fiber posts and cast metal posts that are coupled with single crowns have the potential to be considered viable candidates for ETT restoration in situations where there are no remaining coronal walls. For the purpose of coronal restoration, there is a wide

selection of therapeutic modalities and materials available. Two examples of this would be glass fibre posts and cast metal posts. The annual failure rates (AFRs) for ETT composite restorations vary from 2% to 12.4%, according to Demarco et al. (2012). However, estimates derived from a variety of studies imply that the annual failure rates (AFRs) for ETT after five years range from 1.2% to 1.7%.

AFRs of 4.6% were reported for glass fiber posts after up to 10 years of use, as stated in the data that were published by Naumann et al. (2012). Sarkis-Onofre et al. (2020) carried out research that provided the first comparison between glass fiber posts and cast metal posts for teeth that did not have any surviving coronal walls following a follow-up period of up to 9 years. This research was given in the form of a study that was published in 2020. The low average AFR that was reached was contributed to in part by the controlled environment that was used and the processes that were carried out by students who had been instructed on the matter. Sarkis-Onofre et al. (2020) identified 23 failures in a study that was remarkably comparable to this one. The majority of these failures (10/23) were root fractures.

In the prior study that addressed posts with a variety of elastic moduli, root fractures were something that was brought up for discussion. The researchers Figueiredo et al. (2015) demonstrated that the frequency of root fractures was comparable across metal posts and fibre posts. In light of this, it seems that posts made of glass fiber may not necessarily reduce the incidence of root fractures. The bulk of the failures were seen in the posterior teeth, as shown by the findings of Sarkis-Onofre et al. (2020). This conclusion is consistent with the findings of Garcia et al. (2019), who found identical rates of failure for anterior and posterior teeth that were restored utilizing post-and-core restorations. This finding is in accordance with the findings of Garcia et al. (2019).

However, the results of other studies revealed that there was a larger chance of failure in posterior teeth that did not have remaining coronal walls. It is noteworthy to note that premolars accounted for sixty percent of the failures that were discovered in the study that was carried out by Sarkis-Onofre et al. (2020). This includes the incidence of seven root fractures in total. This might be because the experiment employed only teeth that did not have a ferrule and because having a ferrule had an effect on the survival rate of premolars, as revealed by Skupien et al. (2016).

The randomized controlled trial (RCT) that will be the subject of discussion in this article was carried out on the basis of the assumption that the interventions were equivalent to one another. The purpose of the research was to assess, with the use of a specified margin, the extent to which a new intervention (glass fiber posts) was equivalent to the industry standard (cast metal posts) (Friedman et al., 2015).

Conclusion

Both glass fiber and cast metal posts demonstrated satisfactory clinical performance with comparable levels. However, the time required to fail increased when glass fiber was used.

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